Dynamics of emerald ash borer infestation, ash mortality, succession, and invasive plant species in infested forest ecosystems: What we've learned in Michigan and Ohio

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Outline

- **Ash ecosystems of Ohio and southern Michigan**
- **Collaborative research project and ash monitoring methods**
- **Ash decline and mortality**
- **Ash and EAB dynamics in aftermath forests**
- **Native and non-native plant responses**

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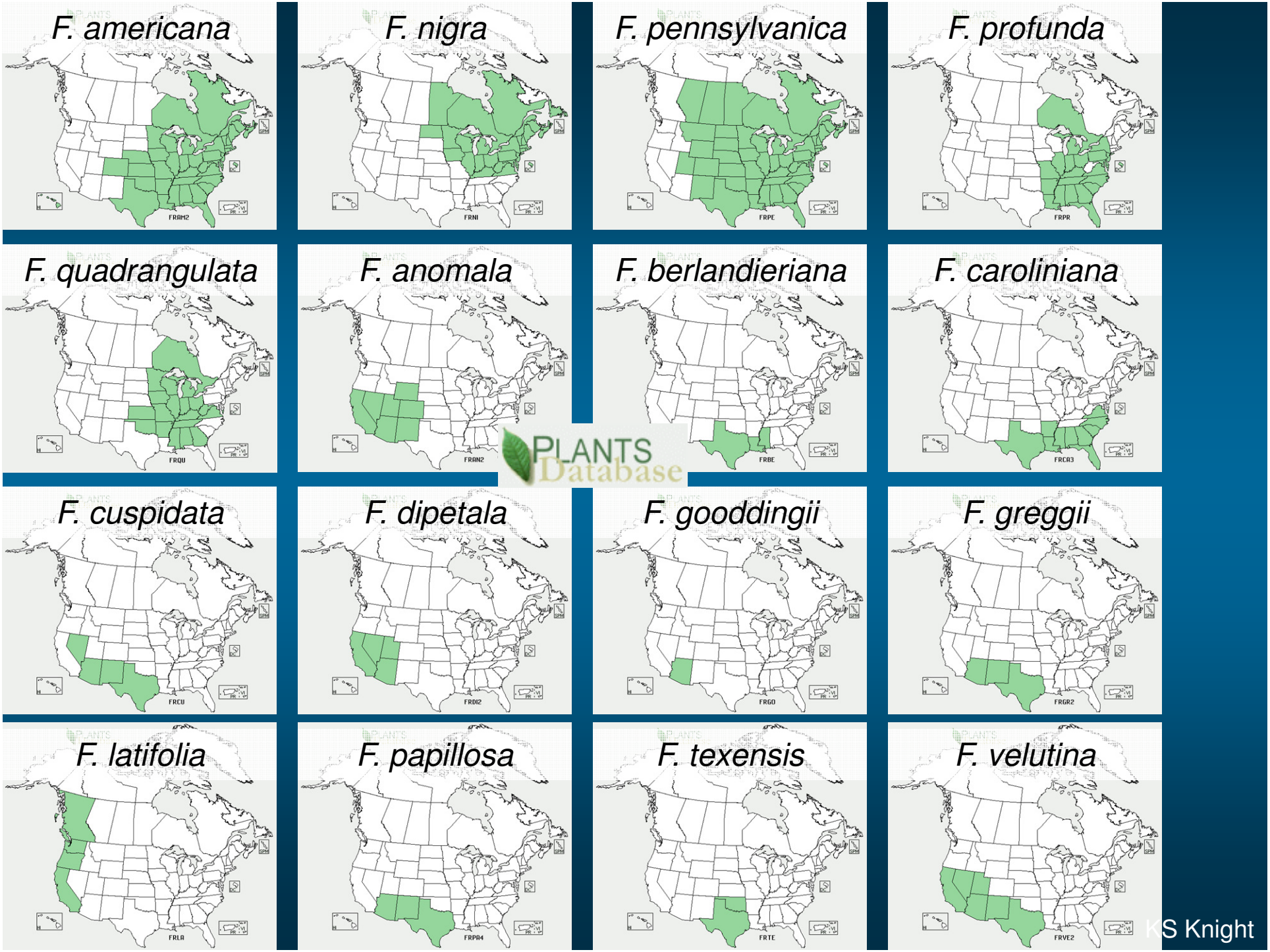
F. americana
FRAM2
F. nigra
FRNI
F. pennsylvanica
FRPE
F. profunda
FRPR
F. quadrangulata
FRQU
F. anomala
FRAN2
F. berlandieriana
FRBE
F. caroliniana
FRCA3
PLANTS Database
F. cuspidata
FRCU
F. dipetala
FRDI2
F. gooddingii
FRGO
F. greggii
FRGR2
F. latifolia
FRLA
F. papillosa
FRPA4
F. texensis
FRTE
F. velutina
FRVE2
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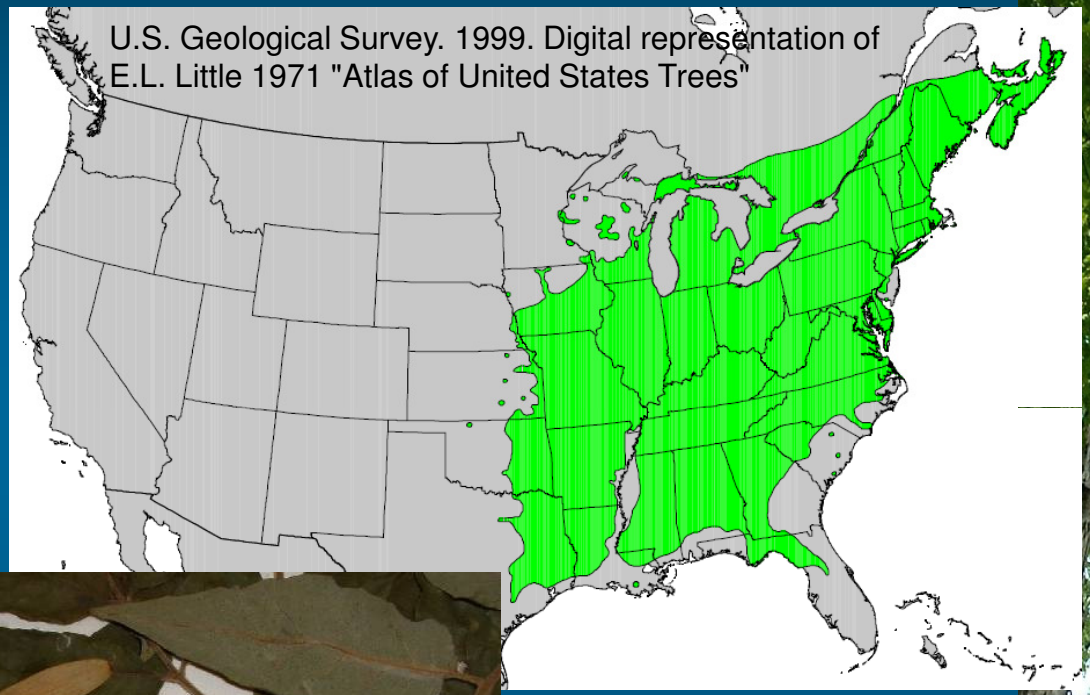
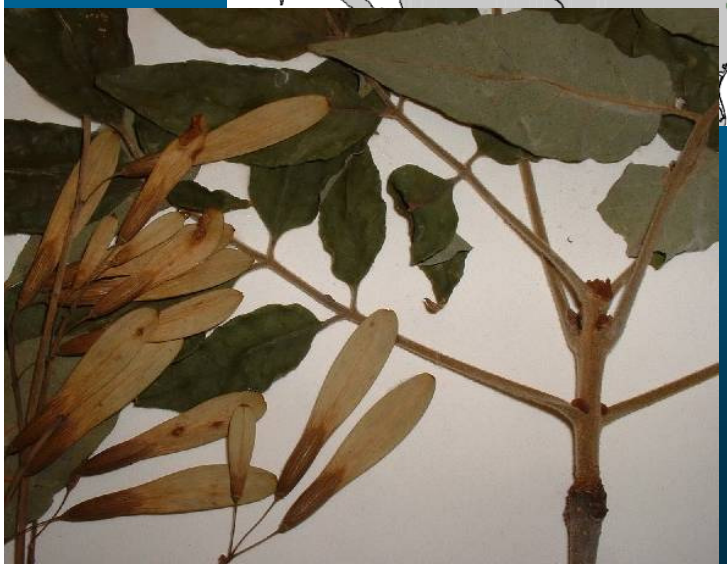
Ash species of the midwest

- White ash (*Fraxinus americana*)





Ash species of the midwest

- Blue ash (*Fraxinus quadrangulata*)

U.S. Geological Survey. 1999. Digital representation of E.L. Little 1971 "Atlas of United States Trees"

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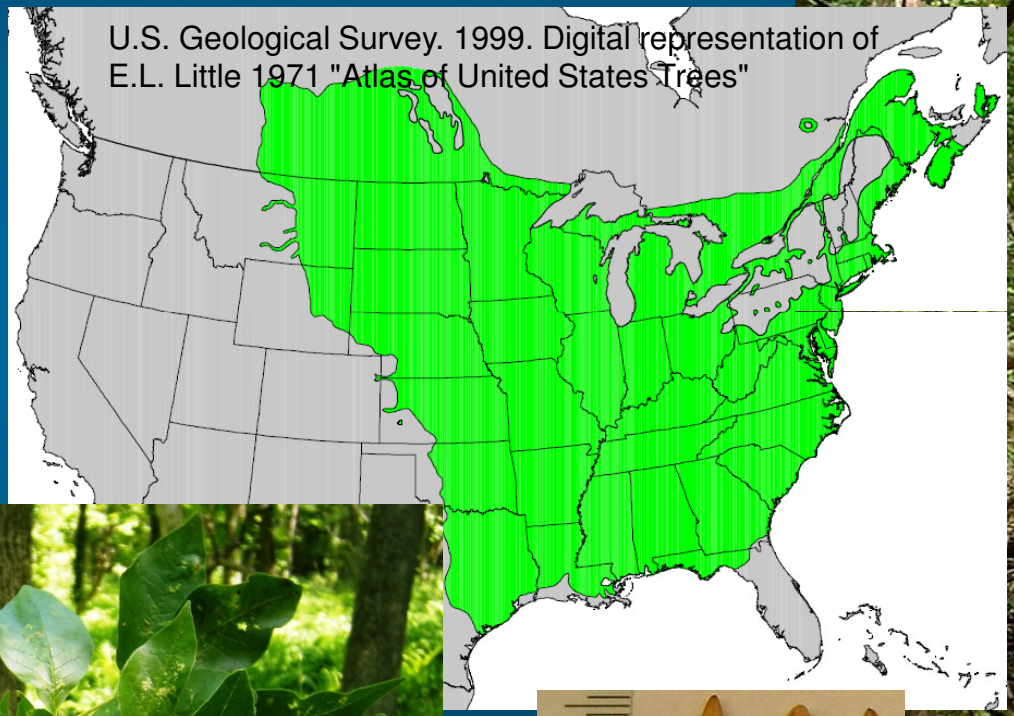
Ash species of the midwest

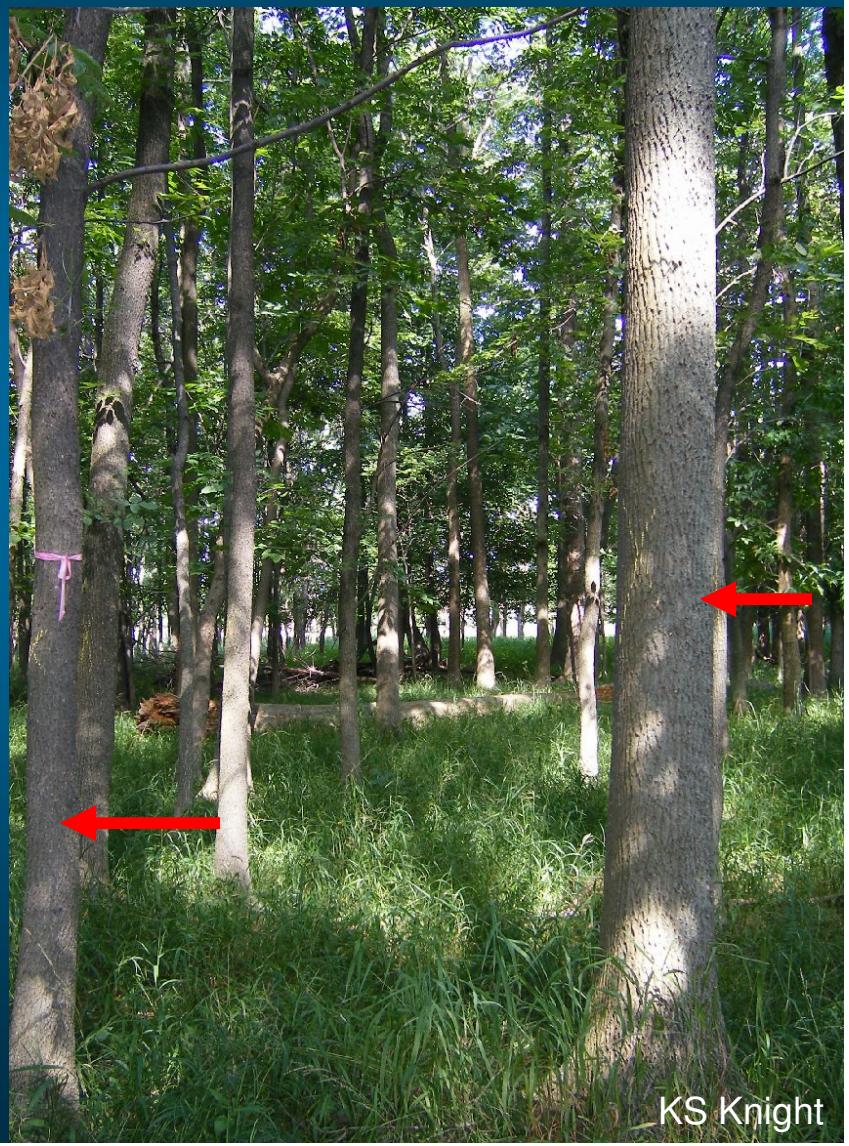
- Green ash (*Fraxinus pennsylvanica*)



Ash species of the midwest

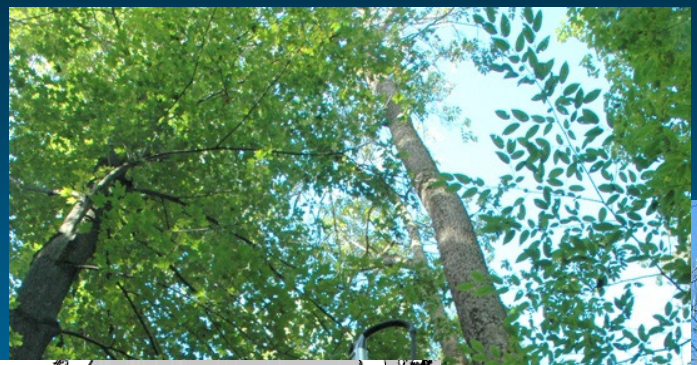
- Pumpkin ash (*Fraxinus profunda or Fraxinus tomentosa*)

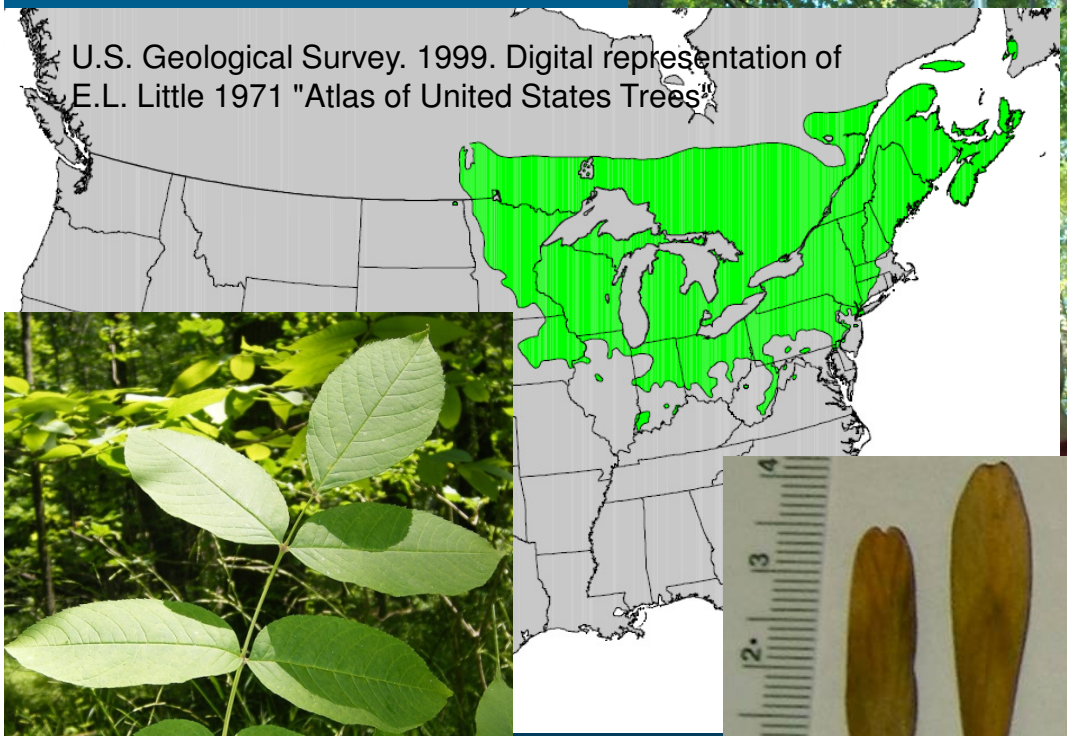
McCormack JS, Bissell JK, & Stine SJ Jr. 1995. The status of *Fraxinus tomentosa* (Oleaceae) with notes on its occurrence in Michigan and Pennsylvania. Castanea 60: 70-78.
With additions from:
Penskar MR. 2004. Special Plant Abstract for *Fraxinus profunda* (pumpkin ash). Michigan Natural Features Inventory. Lansing, MI. 3 pp.
Knight KS. 2007. Unpublished data



Ash species of the midwest

- Black ash (*Fraxinus nigra*)





Black ash ecosystems in Ohio and southern Michigan

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Black ash swamp in early spring, before leaf-out.

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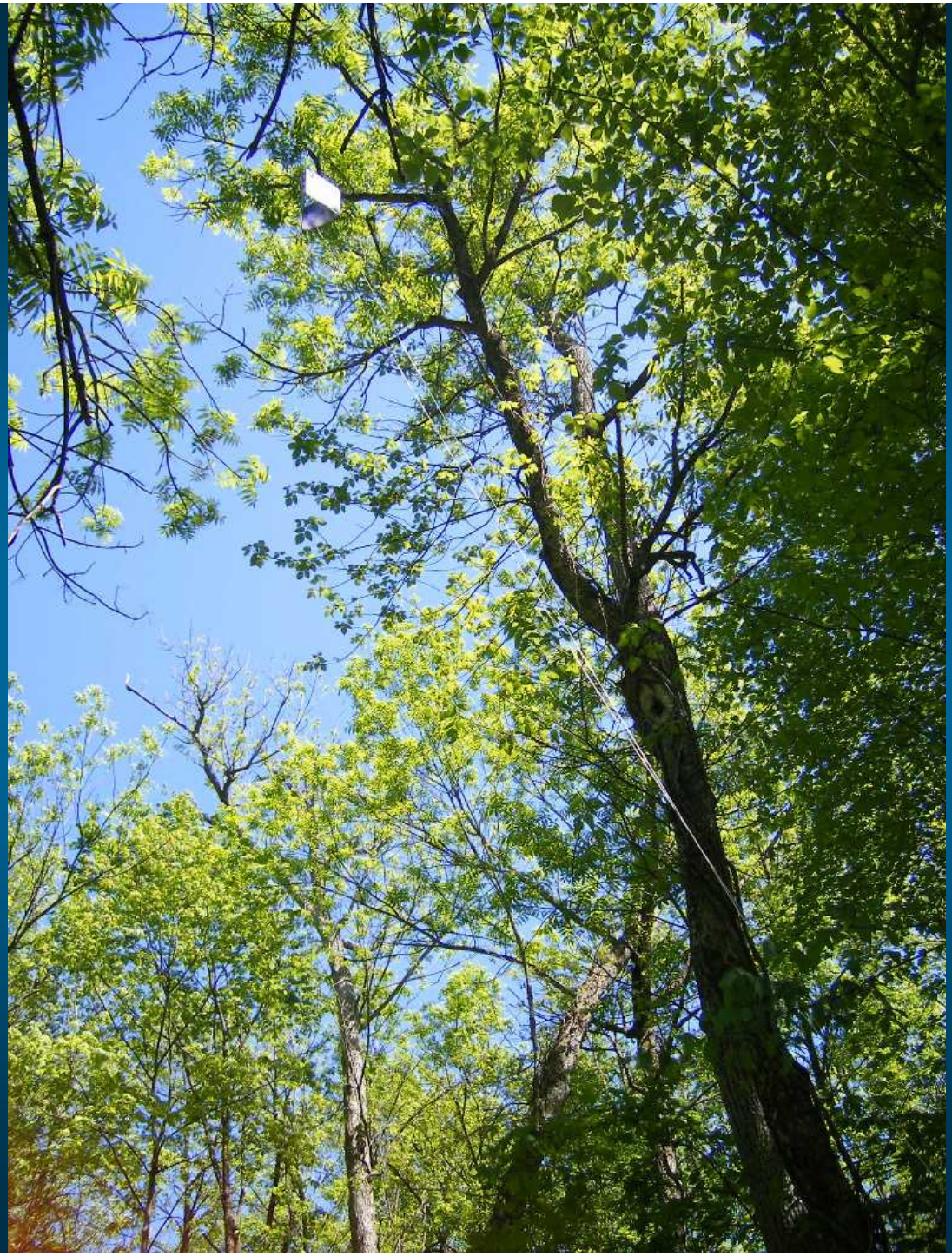

Purple trap in black ash.

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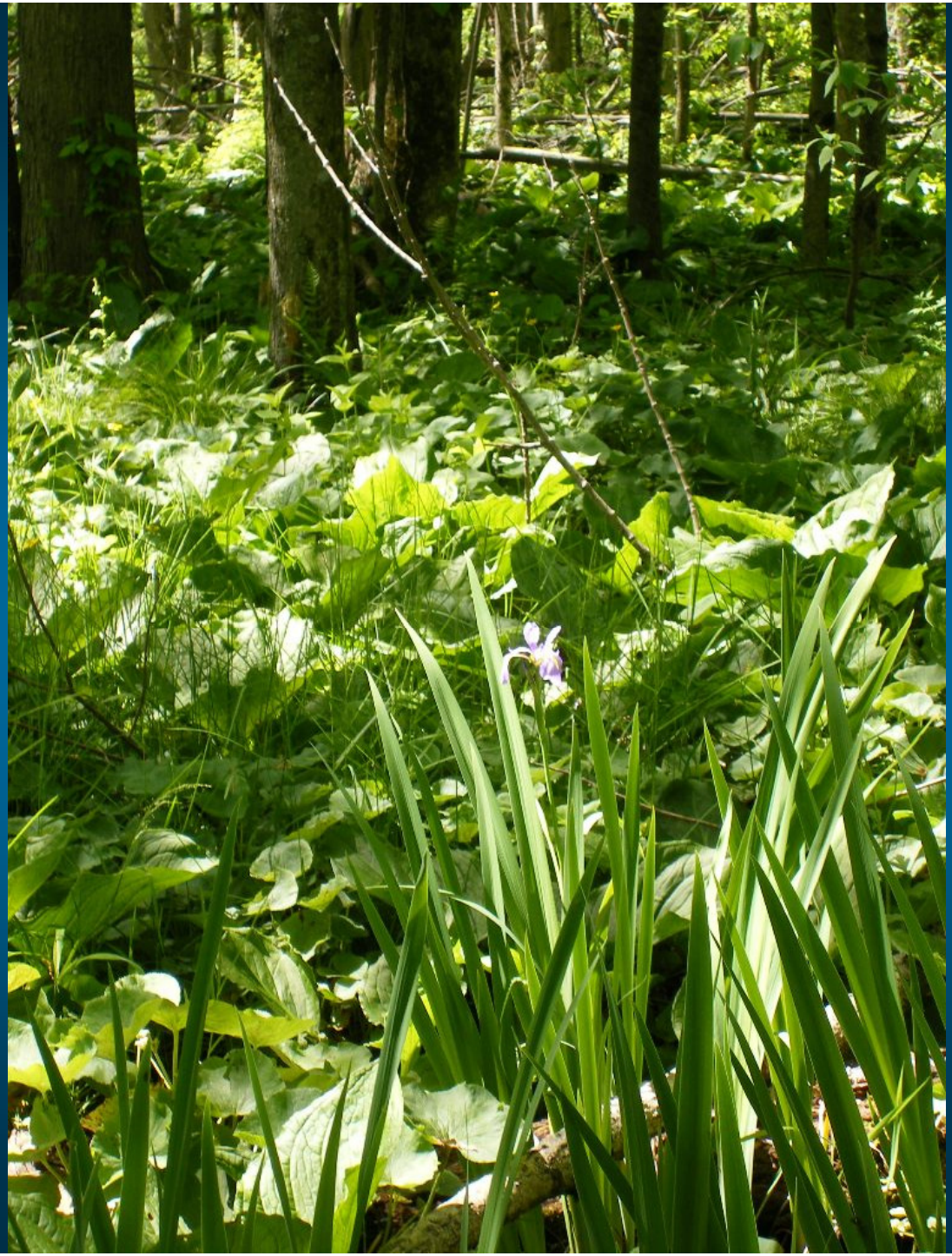

Black ash stand understory vegetation: skunk cabbage, iris

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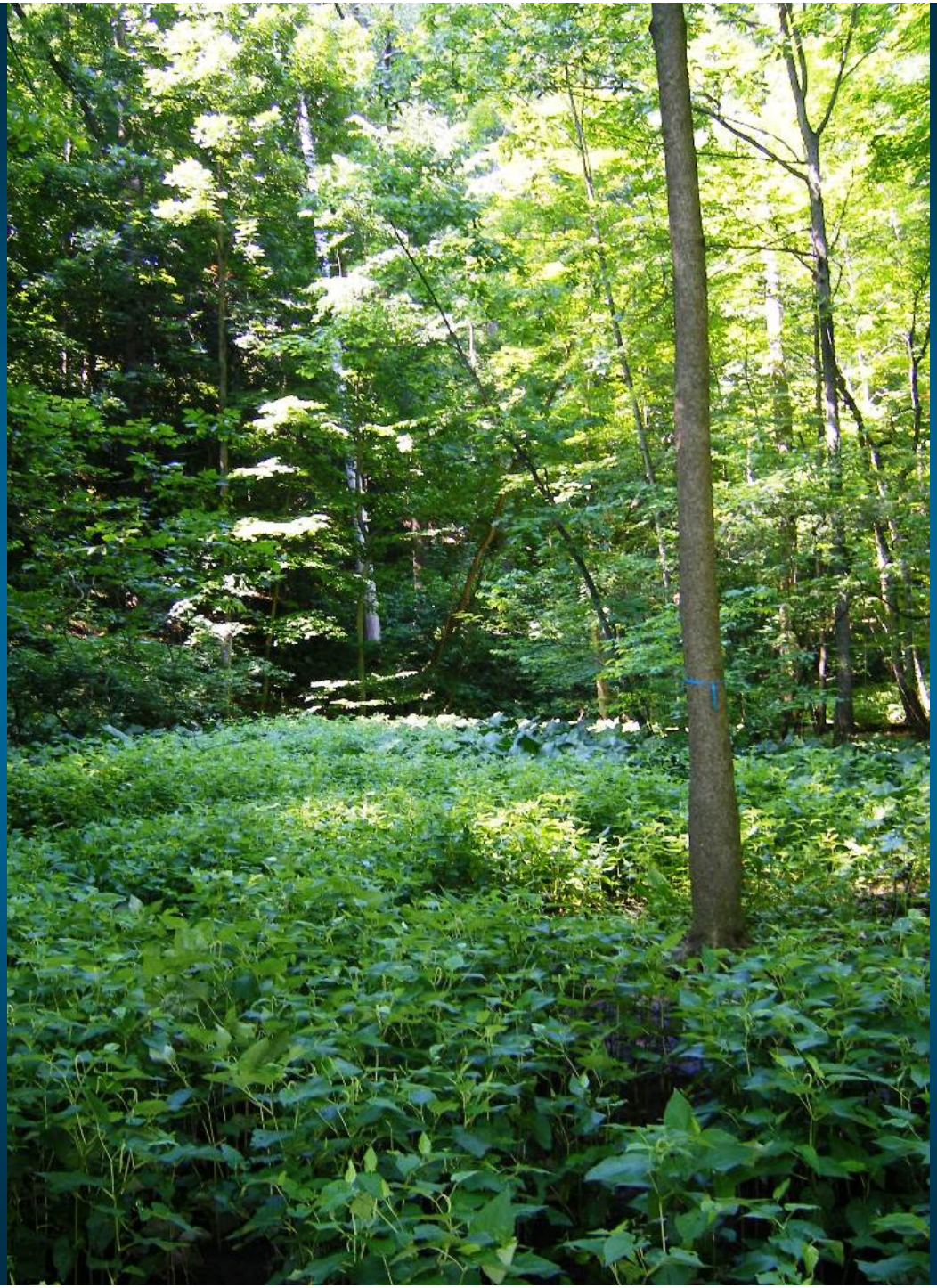
Using slingshot to collect ash seeds from tall black ash (large trunk on right) .

Photo by Tom Arbour, ODNR



Black ash in floodplain, understory vegetation: lizard's tail.

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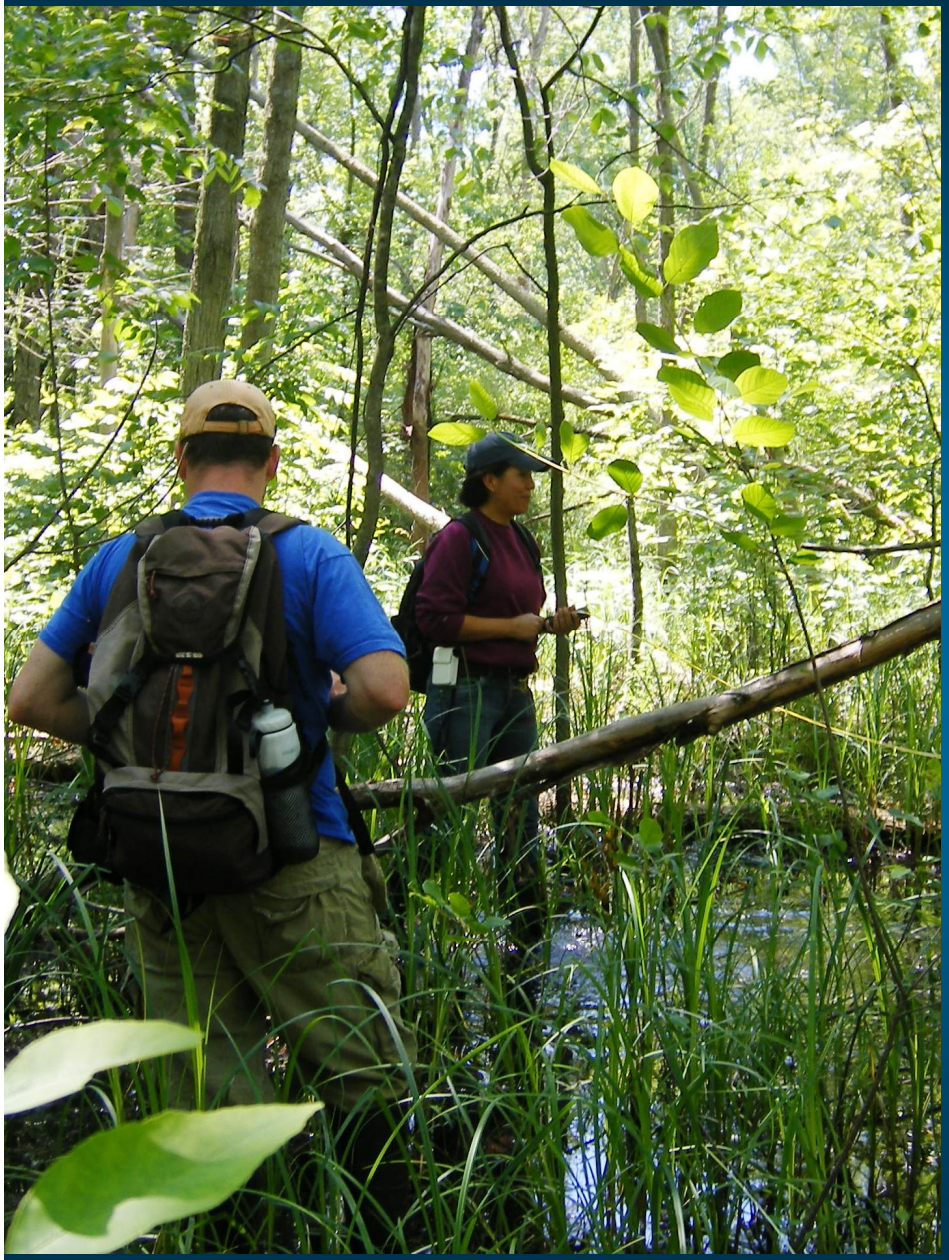

Very wet black ash sites in spring.

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Black ash mortality due to EAB.

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Emerald Ash Borer Forest Ecosystem Effects Research (EAB FEER)

- **Ash decline and mortality**
- **Responses of native and non-native plant species**
- **Changes in species composition and forest structure**
- **Effects on other organisms and ecosystem processes**
- **Accelerated or altered successional trajectory**
- **Education and outreach**

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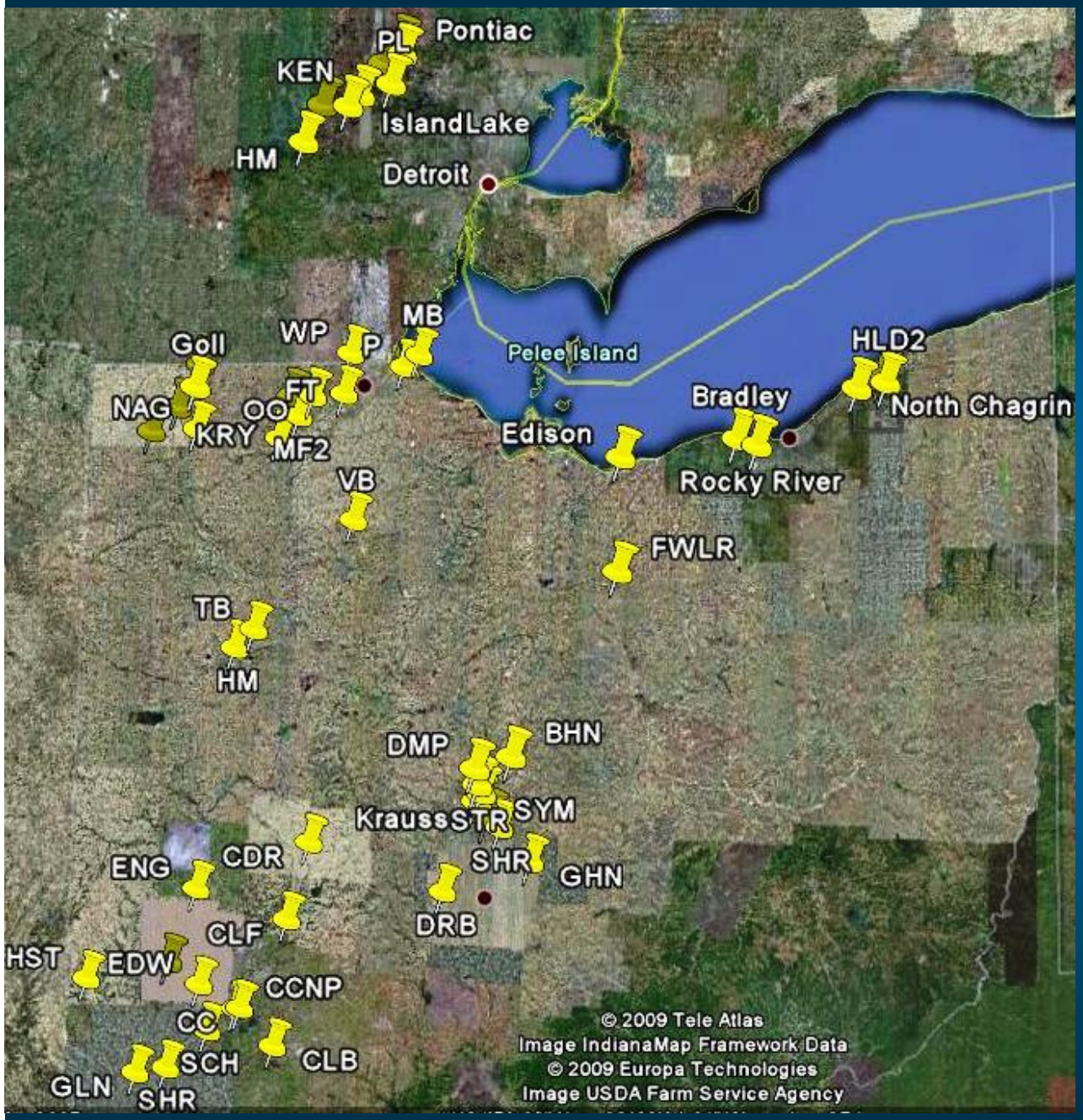

Monitoring sites

Ohio:
165 plots

Michigan:
99 plots

Pennsylvania:
193 paired plots

Gradient of EAB infestation

Variety of habitats and stand ages

5 ash species

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Ash tree health

Ash regeneration

Symptoms of EAB

EAB populations

Native plants

Non-native plants

Light

Soil properties

Land use history

Woodpecker feeding

Ecosystem processes

Other insect species

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Monitoring Ash Canopy Condition

1 2 3 4 5

- Rating scale from healthy (1) to dead (5) canopy (Smith 2006)
- Rating scale closely correlated with EAB gallery density and tree water stress (Flower unpub.)
- If you want to incorporate this rating scale into your work, contact me for methods

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Ash Decline and Mortality

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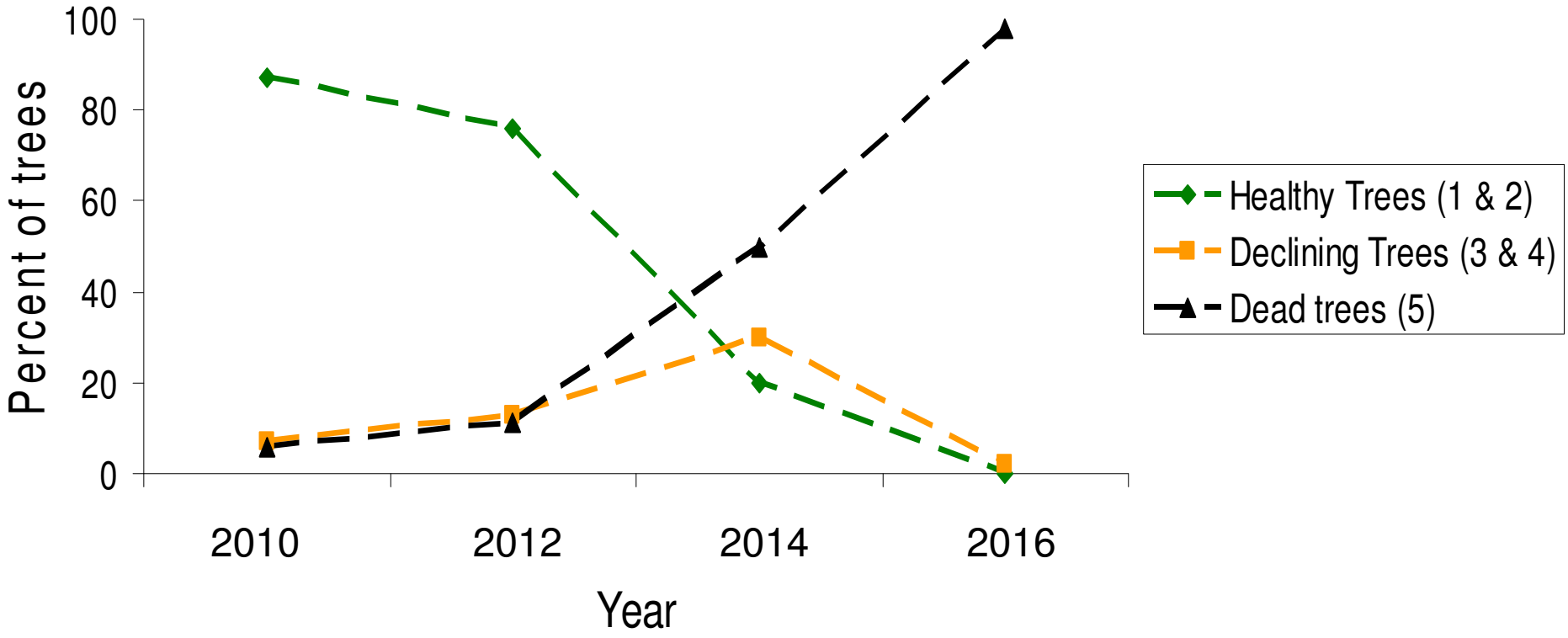
Predicting Future Conditions



Stands can progress from healthy to nearly 100% mortality in 6 years

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2010










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2012










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2014










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2016

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Ash Decline & Mortality Future Plans

- Improve models
- Make available to managers so they can plan timing of management actions
- Link with EAB populations, light, invasive plants
- Use models to detect changes in typical ash mortality patterns and determine effectiveness of emerald ash borer control methods
- Examine landscape patterns of mortality

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EAB Aftermath Forests

- > 99% mortality of ash trees
- Approx 1 in 1000 ash trees appear healthy after others have died
- Scion collection for EAB resistance research (Koch, Herms, Knight, Storer)

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EAB Aftermath Forests

- Cohort of young seedlings and saplings too small to be infested

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EAB in aftermath forests

- Ash >2.5 cm DBH are attacked

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EAB in aftermath forests

- Using purple traps to track EAB populations

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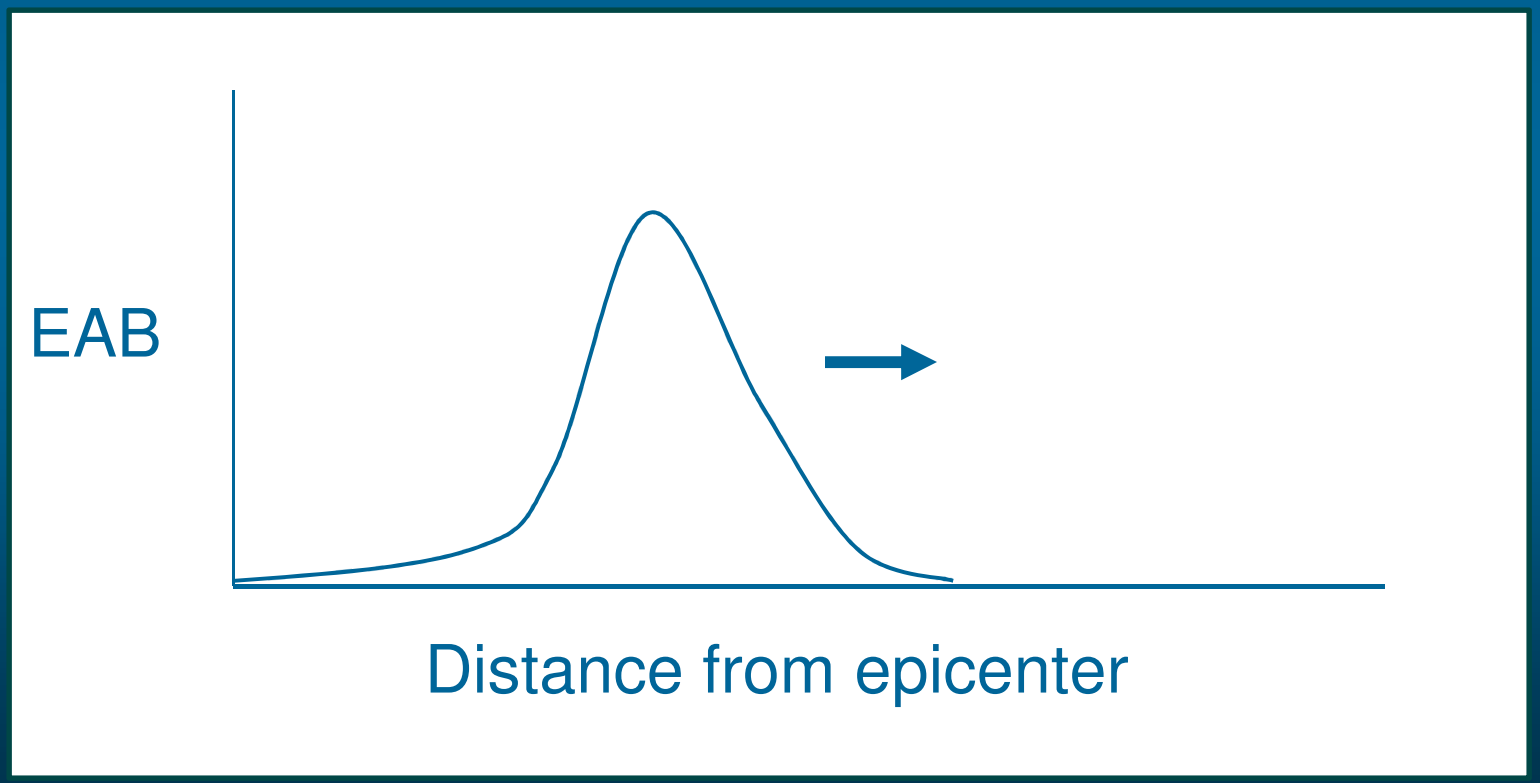
Hypothesis

- EAB populations start small, grow, then crash as they run out of food
- % ash trees alive will correspond to EAB population dynamics across space and time



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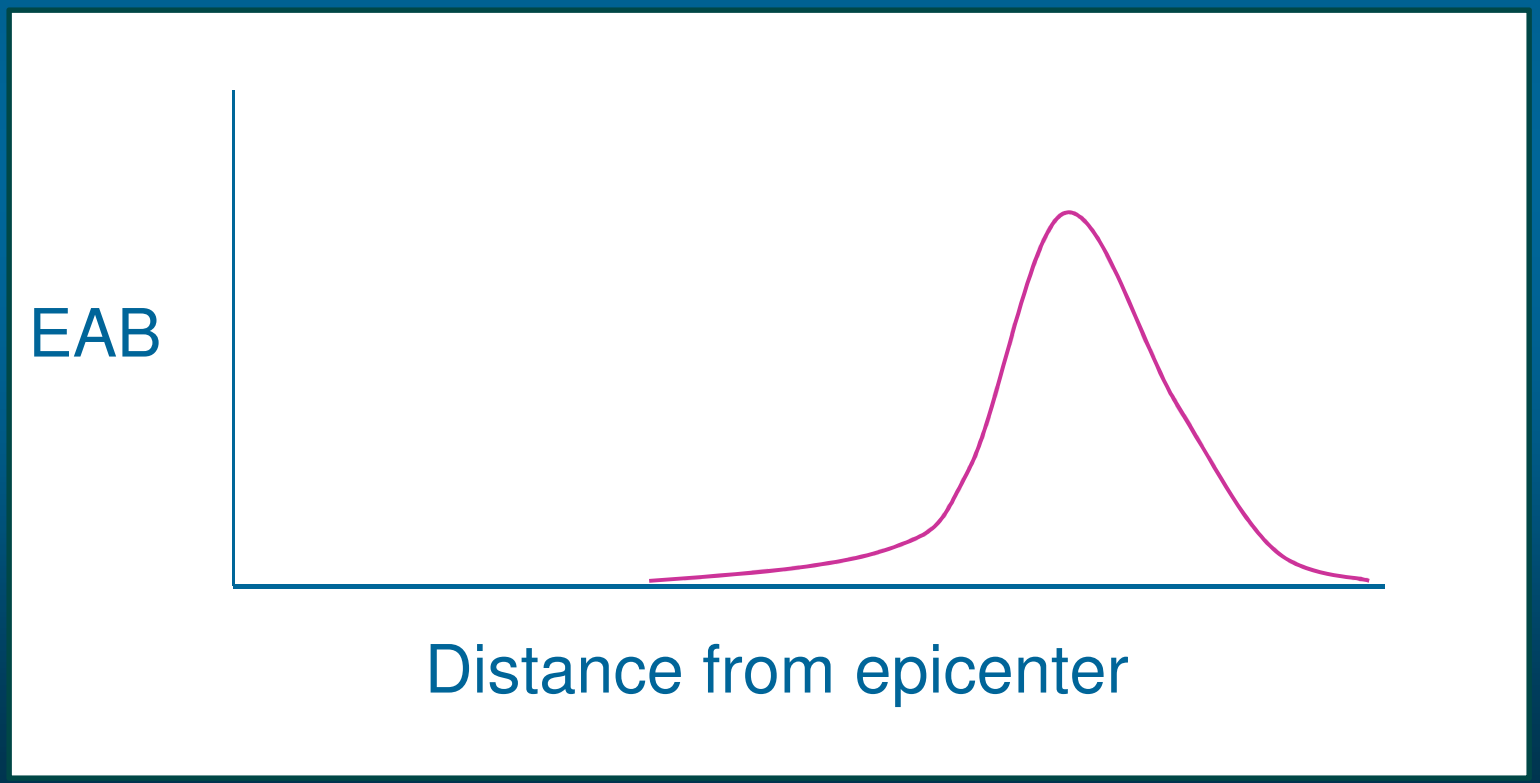

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Aftermath dynamics future work

- Can EAB persist on a dwindling population of saplings?
- Will any saplings survive to reproductive maturity?

- If EAB is locally extirpated, can ash re-establish?

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Non-native plants in ash ecosystems

- Invasive plants are present in many sites
- Initial invasive plant cover is low in most sites
- Invasive plant species associated with habitat, geography, land use history
- Our research will show how these invasives respond to the canopy gaps created by EAB
  - Growth
  - Reproduction
  - What habitats, situations
  - Timing

Invasive species that are associated with ash swamp sites

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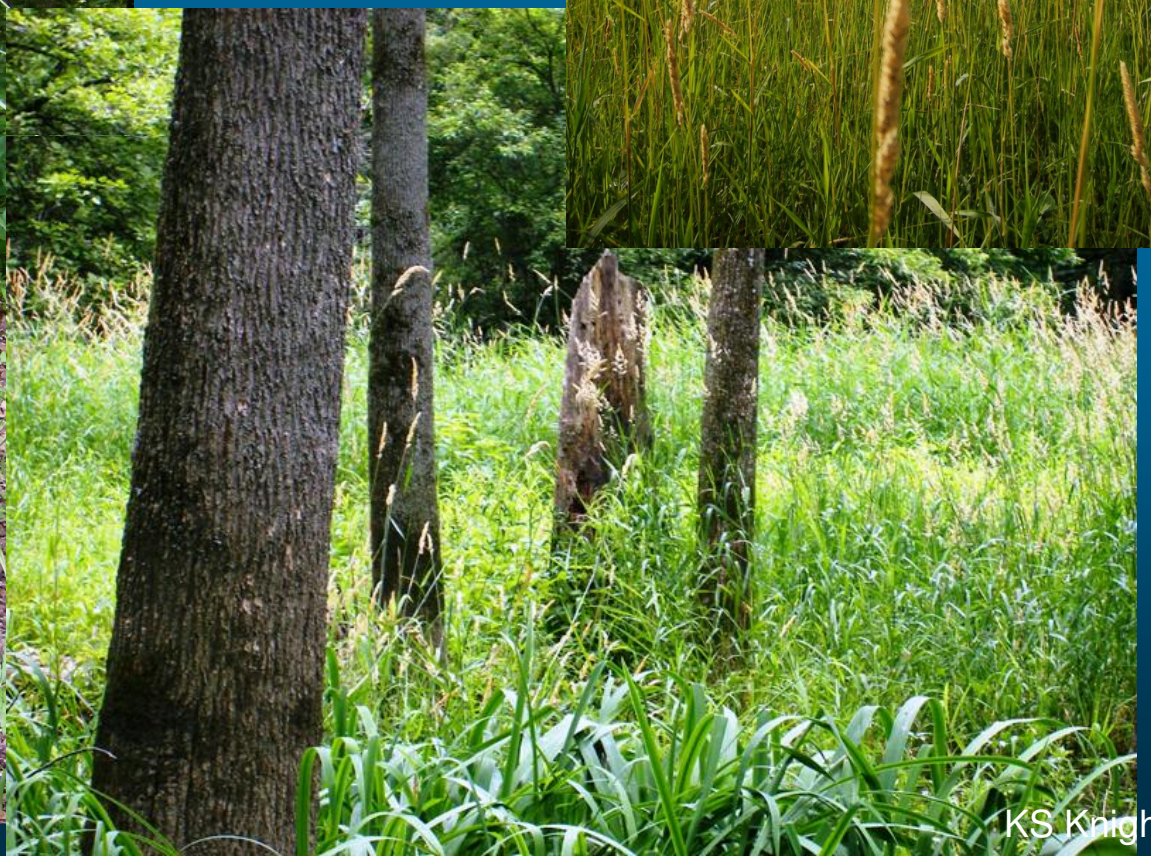
Phalaris arundinacea



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Rhamnus cathartica

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Thank You!

Field Work

Lawrence Long
Kyle Costilow
Charles Flower
Stephanie Smith
Joan Jolliff
Tim Fox
Wynn Johnson
Trevor Walsh
Jenny Finfera
Alejandro Chiriboga
Rodrigo Chorbadjian
Diane Hartzler
B. Chambers
D. Rice
D. Lightle
I. Gomez

Research Sites

Cleveland Metroparks
Toledo Metroparks
Columbus Metro Parks
5 Rivers Metroparks
Hamilton County Park District
Erie Metroparks
Johnny Appleseed Metro Parks
Holden Arboretum
Ohio Division of Natural Areas and Preserves
Ohio State Parks
Dempsey Middle School
Stratford Ecological Center
Huron-Clinton Metroparks
Michigan State Recreational Areas
Private Landowners: Schmerge, Kryder, Lavens, McKinney, Nagel, Planson, Edwards

Manager Input

John Jaeger
Glen Palmgren
Paul Muelli
Karen Gourlay

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